SEQUENCE LISTING

<110> BLACK, Margaret E.

<120> THYMIDINE KINASE MUTANTS AND FUSION
PROTEINS HAVING THYMIDINE KINASE AND GUANYLATE KINASE
ACTIVITIES

<130> 60117-4

<140> 09/173,463
<141> 1998-10-14

<150> 60/061,812
<151> 1997-10-14

<160> 172

<170> FastSEQ for Windows Version 4.0

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gggaaaacca ccaccacgca actgctggtg gccctgggtt cgcgcgacga tatcgtctac 240
gtacccgagc cgatgactta ctggcaggtg ctgggggctt ccgagacaat cgcgaacatc 300
tacaccacac aacaccgcct cgaccagggt gagatatcgg ccggggacgc ggcggtggta 360
atgacaagcg cccagataac aatgggcatg ccttatgccg tgaccgacgc cgttctggct 420
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tccatgcacg tctttatcct ggattacgac caatcgcccg ccggctgccg ggacgccctg 1020
ctgcaactta cctccgggat ggtccagacc cacgtcacca cccccggctc cataccgacg 1080
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<220>
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<400> 5
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cgccctcctg 70

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<220>
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<220>
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1 5 10

<210> 13
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<213> Herpesviridae sp.

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1 5 10

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1 5 10

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Pro Ile Ala Thr Leu Leu Cys Tyr Pro Ala Ala
1 5 10

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<212> PRT
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<220>
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<400> 19
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<220>
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<222> (1)...(33)

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Pro Ile Ala Ala Leu Leu Leu Tyr Pro Thr Ala
1 5 10

<210> 21
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
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<210> 22
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<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<220>
<221> CDS
<222> (1)...(33)

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1 5 10

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ctgctgaaga ggctgctc 18

<210> 29
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<400> 29
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<400> 30
ctggacgtgg acctgcag 18

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<211> 18
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<220>
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<210> 32
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<220>
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<400> 32
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<210> 33
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<220>
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<210> 34
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<220>
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<210> 35
<211> 21
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<220>
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<400> 35
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<210> 36
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<400> 36
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<210> 37
<211> 18
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<400> 37
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<210> 38
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<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 38
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<210> 39
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<220>
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<400> 39
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<210> 40
<211> 18
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<220>
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<400> 40
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<212> DNA
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<220>
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<400> 41
ctaggtcctg ccatggcgtc cgcg 24

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<212> DNA
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<220>
<223> Primer

<400> 42
actactacta gatctcgatc ccgcgaa 27

<210> 43
<211> 41
<212> DNA
<213> Artificial Sequence

<220>
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<400> 43
atgatgatga tgatggctgc tagccatagt atatctcctt c 41

<210> 44
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<220>
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<211> 42
<212> DNA
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<220>
<223> Primer

<400> 45
agtagtatcc atggagctgc cgcgcggcac caggccgctg ct 42

<210> 46
<211> 21
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1 5 10 15
Arg Gly Ser Ser Met
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<210> 47
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<212> PRT
<213> Herpesviridae sp.

<400> 47
Ala Leu Thr Leu Ile Phe Asp Arg His Pro Ile Ala Ala Leu Leu Cys
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Tyr Pro Ile

<210> 48
<211> 606
<212> DNA
<213> Homo sapiens

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<222> (7)...(597)

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Met Ala Gly Pro Arg Pro Val Val Leu Ser Gly Pro Ser Gly
1 5 10

gct ggg aag agc acc ctg ctg aag agg ctg ctc cag gag cac agc ggc 96
Ala Gly Lys Ser Thr Leu Leu Lys Arg Leu Leu Gln Glu His Ser Gly
15 20 25 30

atc ttt ggc ttc agc gtg tcc cat acc acg agg aac ccg agg ccc ggc 144
Ile Phe Gly Phe Ser Val Ser His Thr Thr Arg Asn Pro Arg Pro Gly
35 40 45

gag gag aac ggc aaa gat tac tac ttt gta acc agg gag gtg atg cag 192
Glu Glu Asn Gly Lys Asp Tyr Tyr Phe Val Thr Arg Glu Val Met Gln
50 55 60

cgt gac ata gca gcc ggc gac ttc atc gag cat gcc gag ttc tcg ggg 240
Arg Asp Ile Ala Ala Gly Asp Phe Ile Glu His Ala Glu Phe Ser Gly
65 70 75

aac ctg tat ggc acg agc aag gtg gcg gtg cag gcc gtg cag gcc atg 288
Asn Leu Tyr Gly Thr Ser Lys Val Ala Val Gln Ala Val Gln Ala Met
80 85 90

aac cgc atc tgt gtg ctg gac gtg gac ctg cag ggt gtg cgg aac atc 336
Asn Arg Ile Cys Val Leu Asp Val Asp Leu Gln Gly Val Arg Asn Ile
95 100 105 110

aag gcc acc gat ctg cgg ccc atc tac atc tct gtg cag ccg cct tca 384
Lys Ala Thr Asp Leu Arg Pro Ile Tyr Ile Ser Val Gln Pro Pro Ser
115 120 125

ctg cac gtg ctg gag cag cgg ctg cgg cag cgc aac act gaa acc gag 432
Leu His Val Leu Glu Gln Arg Leu Arg Gln Arg Asn Thr Glu Thr Glu
130 135 140

gag agc ctg gtg aag cgg ctg gct gct gcc cag gcc gac atg gag agc 480
Glu Ser Leu Val Lys Arg Leu Ala Ala Ala Gln Ala Asp Met Glu Ser
145 150 155

agc aag gag ccc ggc ctg ttt gat gtg gtc atc att aac gac agc ctg 528
Ser Lys Glu Pro Gly Leu Phe Asp Val Val Ile Ile Asn Asp Ser Leu
160 165 170

gac cag gcc tac gca gag ctg aag gag gcg ctc tct gag gaa atc aag 576
Asp Gln Ala Tyr Ala Glu Leu Lys Glu Ala Leu Ser Glu Glu Ile Lys
175 180 185 190

aaa gct caa agg acc ggc gcc tgaggatcc 606
Lys Ala Gln Arg Thr Gly Ala
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<210> 49
<211> 197
<212> PRT
<213> Homo sapiens

<400> 49
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1 5 10 15

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Gly Phe Ser Val Ser His Thr Thr Arg Asn Pro Arg Pro Gly Glu Glu
        35                  40                  45
Asn Gly Lys Asp Tyr Tyr Phe Val Thr Arg Glu Val Met Gln Arg Asp
    50                  55                  60
Ile Ala Ala Gly Asp Phe Ile Glu His Ala Glu Phe Ser Gly Asn Leu
65                  70                  75                  80
Tyr Gly Thr Ser Lys Val Ala Val Gln Ala Val Gln Ala Met Asn Arg
                85                  90                  95
Ile Cys Val Leu Asp Val Asp Leu Gln Gly Val Arg Asn Ile Lys Ala
            100                 105                 110
Thr Asp Leu Arg Pro Ile Tyr Ile Ser Val Gln Pro Pro Ser Leu His
        115                 120                 125
Val Leu Glu Gln Arg Leu Arg Gln Arg Asn Thr Glu Thr Glu Glu Ser
    130                 135                 140
Leu Val Lys Arg Leu Ala Ala Ala Gln Ala Asp Met Glu Ser Ser Lys
145                 150                 155                 160
Glu Pro Gly Leu Phe Asp Val Val Ile Ile Asn Asp Ser Leu Asp Gln
                165                 170                 175
Ala Tyr Ala Glu Leu Lys Glu Ala Leu Ser Glu Glu Ile Lys Lys Ala
            180                 185                 190
Gln Arg Thr Gly Ala
        195


<210> 50
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<212> DNA
<213> Mus musculus

<220>
<221> CDS
<222> (25)...(618)

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                            1               5

agc ggg ccg tca ggg gca ggg aag agc act ctg ctc aag aag ctg ttc   99
Ser Gly Pro Ser Gly Ala Gly Lys Ser Thr Leu Leu Lys Lys Leu Phe
 10                  15                  20                  25

cag gag cac agc agc atc ttc ggc ttc agt gtg tcc cat act aca agg   147
Gln Glu His Ser Ser Ile Phe Gly Phe Ser Val Ser His Thr Thr Arg
                30                  35                  40

aac cca cga cct ggt gaa gaa gat ggc aaa gat tac tac ttt gtg acc   195
Asn Pro Arg Pro Gly Glu Glu Asp Gly Lys Asp Tyr Tyr Phe Val Thr
            45                  50                  55

agg gag atg atg cag cgt gat att gca gca ggg gac ttc att gag cat   243
Arg Glu Met Met Gln Arg Asp Ile Ala Ala Gly Asp Phe Ile Glu His
        60                  65                  70

gct gag ttc tca ggg aac ctg tac ggg aca agc aag gaa gct gtt cgg   291
Ala Glu Phe Ser Gly Asn Leu Tyr Gly Thr Ser Lys Glu Ala Val Arg
    75                  80                  85

gct gtg cag gcc atg aac cgc atc tgc gtg cta gat gtc gac cta caa   339
Ala Val Gln Ala Met Asn Arg Ile Cys Val Leu Asp Val Asp Leu Gln
 90                  95                  100                 105
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ggt gtg cgc agc atc aag aag act gat ctg tgt ccc atc tac atc ttt   387
Gly Val Arg Ser Ile Lys Lys Thr Asp Leu Cys Pro Ile Tyr Ile Phe
                110                 115                 120

gtg cag cct ccc tcg ctg gac gtg ctg gag caa cga ctg cga ctg cgc   435
Val Gln Pro Pro Ser Leu Asp Val Leu Glu Gln Arg Leu Arg Leu Arg
            125                 130                 135

aac act gag act gag gag agt ctg gca aag cgg ctg gca gct gca cgg   483
Asn Thr Glu Thr Glu Glu Ser Leu Ala Lys Arg Leu Ala Ala Ala Arg
        140                 145                 150

aca gac atg gag agc agc aag gag cct ggc ttg ttt gac ctg gtg atc   531
Thr Asp Met Glu Ser Ser Lys Glu Pro Gly Leu Phe Asp Leu Val Ile
    155                 160                 165

atc aat gac gac ctg gat aaa gcc tat gca acc ctg aag cag gcg ctc   579
Ile Asn Asp Asp Leu Asp Lys Ala Tyr Ala Thr Leu Lys Gln Ala Leu
170                 175                 180                 185

tct gag gaa atc aag aaa gca cag gga act ggc cac gcc tgaaggcctg   628
Ser Glu Glu Ile Lys Lys Ala Gln Gly Thr Gly His Ala
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<210> 51
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<213> Mus musculus

<400> 51

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Gly Phe Ser Val Ser His Thr Thr Arg Asn Pro Arg Pro Gly Glu Glu
        35                  40                  45
Asp Gly Lys Asp Tyr Tyr Phe Val Thr Arg Glu Met Met Gln Arg Asp
    50                  55                  60
Ile Ala Ala Gly Asp Phe Ile Glu His Ala Glu Phe Ser Gly Asn Leu
65                  70                  75                  80
Tyr Gly Thr Ser Lys Glu Ala Val Arg Ala Val Gln Ala Met Asn Arg
                85                  90                  95
Ile Cys Val Leu Asp Val Asp Leu Gln Gly Val Arg Ser Ile Lys Lys
            100                 105                 110
Thr Asp Leu Cys Pro Ile Tyr Ile Phe Val Gln Pro Pro Ser Leu Asp
        115                 120                 125
Val Leu Glu Gln Arg Leu Arg Leu Arg Asn Thr Glu Thr Glu Glu Ser
    130                 135                 140
Leu Ala Lys Arg Leu Ala Ala Ala Arg Thr Asp Met Glu Ser Ser Lys
145                 150                 155                 160
Glu Pro Gly Leu Phe Asp Leu Val Ile Ile Asn Asp Asp Leu Asp Lys
                165                 170                 175
Ala Tyr Ala Thr Leu Lys Gln Ala Leu Ser Glu Glu Ile Lys Lys Ala
            180                 185                 190
Gln Gly Thr Gly His Ala
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<220>
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<400> 52
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<210> 53
<211> 18
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<220>
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<400> 53
ctcagtgttg cccagtcg 18

<210> 54
<211> 18
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<220>
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<400> 54
gccgaagatg ctgctgtg 18

<210> 55
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<220>
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<222> (1)...(33)

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Pro Ile Ala Ala Leu Ile Cys Tyr Pro Ala Ala
1 5 10

<210> 56
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<213> Artificial Sequence

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<400> 56
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1 5 10

<210> 57

<211> 33
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<220>
<221> CDS
<222> (1)...(33)

<400> 57
cac atc tcg gcc ctc ctg tgc tac ccg gtc gcg 33
His Ile Ser Ala Leu Leu Cys Tyr Pro Val Ala
 1 5 10

<210> 58
<211> 11
<212> PRT
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<220>
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<400> 58
His Ile Ser Ala Leu Leu Cys Tyr Pro Val Ala
 1 5 10

<210> 59
<211> 72
<212> DNA
<213> Herpesviridae sp.

<220>
<221> CDS
<222> (1)...(72)

<400> 59
tca cat gcc ccg ccc ccg gcc ctc acc ctc atc ttc gac cgc cat ccc 48
Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile Phe Asp Arg His Pro
 1 5 10 15

atc gcc gcc ctc ctg tgc tac ccg 72
Ile Ala Ala Leu Leu Cys Tyr Pro
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<210> 60
<211> 24
<212> PRT
<213> Herpesviridae sp.

<400> 60
Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile Phe Asp Arg His Pro
 1 5 10 15
Ile Ala Ala Leu Leu Cys Tyr Pro
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<210> 61
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<212> DNA
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<220>
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ctttgctacc cg 72

<210> 63
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<220>
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ctatgctacc cg 72

<210> 64
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<220>
<223> HSVTK Mutant

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tgttgctacc cg 72

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gtatgctacc cg 72

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<210> 67
<211> 69
<212> DNA
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<220>
<223> HSVTK Mutant

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tgctacccg 69

<210> 68
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<220>
<223> HSVTK Mutant

<400> 68
tcacatgccc cgcccccggc cctcaccttg ttcctcgacc gccatcccat cgccctcatg 60
tgttgctacc cg 72

<210> 69
<211> 69
<212> DNA
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 69
tcacatgccc cgccccccct caccctcgta ttagaccgtc atcccatcgc ctactatcta 60
tgctaccct 69

<210> 70
<211> 69
<212> DNA
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 70
tcacatgccc cgccggccct cacctgtttt ctcgaccgcc atcccatcgc ctattatctt 60
tgctacccg 69

<210> 71
<211> 15
<212> PRT
<213> Herpesviridae sp.

<400> 71
Leu Ile Phe Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro
1 5 10 15

<210> 72
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 72
Leu Val Phe Asp Arg His Pro Ile Ala Thr Leu Leu Cys Tyr Pro
 1   5   10   15

<210> 73
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 73
Phe Ile Phe Asp Arg His Pro Ile Ala Tyr Tyr Ile Cys Tyr Pro
 1   5   10   15

<210> 74
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 74
Val Leu Ser Asp Arg His Pro Ile Ala Arg Ile Tyr Cys Tyr Pro
 1   5   10   15

<210> 75
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 75
Leu Ile Leu Asp Arg His Pro Ile Ala Asn Phe Ile Cys Tyr Pro
 1   5   10   15

<210> 76
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 76

Thr Phe Tyr Asp Arg His Pro Ile Ala Trp Met Phe Cys Tyr Pro
1 5 10 15

<210> 77
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 77
Val Val Cys Asp Arg His Pro Ile Ala Cys Thr Leu Cys Tyr Pro
1 5 10 15

<210> 78
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 78
Leu Phe Ala Asp Arg His Pro Ile Ala Thr Leu Leu Cys Tyr Pro
1 5 10 15

<210> 79
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 79
Val Phe Ser Asp Arg His Pro Ile Ala Leu Leu Leu Cys Tyr Pro
1 5 10 15

<210> 80
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 80
Leu Cys Phe Asp Arg His Pro Ile Ala Tyr Cys Ile Cys Tyr Pro
1 5 10 15

<210> 81
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 81
Ile Ile Ala Asp Arg His Pro Ile Ala Leu Leu Val Cys Tyr Pro
 1   5   10   15

<210> 82
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 82
Leu Ile Leu Asp Arg His Pro Ile Ala Val Ser Leu Cys Tyr Pro
 1   5   10   15

<210> 83
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 83
Leu Leu His Asp Arg His Pro Ile Ala Val Cys Val Cys Tyr Pro
 1   5   10   15

<210> 84
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 84
Leu Leu Ser Asp Arg His Pro Ile Ala Tyr His Leu Cys Tyr Pro
 1   5   10   15

<210> 85
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 85
Phe Leu Val Asp Arg His Pro Ile Ala Trp Asn Leu Cys Tyr Pro
 1   5   10   15

<210> 86
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 86
Thr Val Phe Asp Arg His Pro Ile Ala Ser Thr Phe Cys Tyr Pro
 1   5   10   15

<210> 87
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 87
Leu Thr Phe Asp Arg His Pro Ile Ala Gly Thr Leu Cys Tyr Pro
 1   5   10   15

<210> 88
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 88
Leu Phe Ile Asp Arg His Pro Ile Ala Thr Ile Leu Cys Tyr Pro
 1   5   10   15

<210> 89
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 89
Val Ala Ala Asp Arg His Pro Ile Ala Phe Ser Tyr Cys Tyr Pro
 1   5   10   15

<210> 90
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 90
Pro Thr Gln Asp Arg His Pro Ile Ala Ser Asp Pro Cys Tyr Pro
 1   5   10   15

<210> 91
<211> 15
<212> PRT

<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 91
Arg Ala Phe Asp Arg His Pro Ile Gly Gln Thr Ser Cys Tyr Pro
 1   5   10   15

<210> 92
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 92
Asp Gly Val Asp Arg His Pro Ile Ala Cys Arg His Cys Tyr Pro
 1   5   10   15

<210> 93
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 93
Asp Asn Asn Asp Arg His Pro Ile Ala Gln Ser Pro Cys Tyr Pro
 1   5   10   15

<210> 94
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 94
Ile Leu Asn Asp Arg His Pro Ile Ala Arg Thr
 1   5   10

<210> 95
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 95
Phe Leu Asp Asp Arg His Pro Ile Ala Pro Leu Leu Cys Tyr Pro
 1   5   10   15

<210> 96

<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 96
Tyr Tyr Val Asp Arg His Pro Ile Ala Val Ser Leu Cys Tyr Pro
 1   5   10   15

<210> 97
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 97
Asp Arg His Pro Ile Ala Leu Arg Ser Cys Asn Pro
 1   5   10

<210> 98
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 98
Leu Asn Pro Asp Arg His Pro Ile Ala Cys Asp Cys Cys Tyr Pro
 1   5   10   15

<210> 99
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 99
Ser Trp Gly Asp Arg His Pro Ile Glu Lys Phe Ile
 1   5   10

<210> 100
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 100
Tyr Gly Ser Asp Arg His Pro Ile Ala Ile Cys Pro Cys Tyr Pro
 1   5   10   15

<210> 101
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 101
Asp Arg His Pro Ile Ala Ile Ile
 1   5

<210> 102
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 102
Tyr Tyr Asn Asp Arg His Pro Ile Ala Gly Ser Pro Cys Tyr Pro
 1   5   10   15

<210> 103
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 103
Trp Gly Arg Asp Arg His Pro Ile Ala Asn Leu Leu Cys Tyr Pro
 1   5   10   15

<210> 104
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 104
Arg Leu Pro Asp Arg His Pro Ile Ala Asn Glu Ala Cys Tyr Pro
 1   5   10   15

<210> 105
<211> 12
<212> PRT
<213> Herpesviridae sp.

<400> 105
Leu Ile Phe Asp Arg His Pro Ile Ala Ala Leu Leu
 1   5   10

<210> 106
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 106
Leu Phe Leu Asp Arg His Pro Ile Ala Phe Asn Leu
 1   5   10

<210> 107
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 107
Leu Phe Ala Asp Arg His Pro Ile Ala Phe Leu Leu
 1   5   10

<210> 108
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 108
Ile Phe Leu Asp Arg His Pro Ile Ala Phe Met Leu
 1   5   10

<210> 109
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 109
Ile Leu Leu Asp Arg His Pro Ile Ala Tyr Leu Leu
 1   5   10

<210> 110
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 110
Leu Phe Ala Asp Arg His Pro Ile Ala Tyr Tyr Leu
 1   5   10

<210> 111
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 111
Leu Phe Val Asp Arg His Pro Ile Ala Val Met Leu
 1   5   10

<210> 112
<211> 12
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 112
Ile Phe Val Asp Arg His Pro Ile Ala Phe Tyr Leu
 1   5   10

<210> 113
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 113
gtctcggagg cgcccagcac c   21

<210> 114
<211> 59
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 114
aggctgggag ctcacatgcc ccgcccccgg ccctcaccac tcttgcgcct cgaccgcca 59

<210> 115
<211> 54
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 115
ataaggtacc gcgcggccgg gtagcacaga catgtacagg cgatgggatg gcgg   54

<210> 116
<211> 55

<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 116
cgcctcgacc agggtgagat atcggccggg gacgcggcgg tggtaatgac aagcg 55

<210> 117
<211> 58
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 117
gaacggcgtc ggtcacggca taaggcatgc ccattgttat ctgggcgctt gtcattac 58

<210> 118
<211> 60
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 118
ggcgcctccg agacaatcgc gaacatctac accacacaac accgcctcga ccagggtgag 60

<210> 119
<211> 59
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 119
tcgactgagc tcccagcctc ccccccgata tgaggagcca gaacggcgtc ggtcacggc 59

<210> 120
<211> 24
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 120
gcagctggcg cctccgagac aatc 24

<210> 121
<211> 19
<212> DNA
<213> Artificial Sequence

<220>
<223> Oligonucleotide used to generate TK mutants

<400> 121

tcgactgagc tcccagcct 19

<210> 122
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 122
Ser His Ala Pro Pro Pro Ala Leu Thr Ile Leu Ala Asp Arg His Pro
1 5 10 15
Ile Ala Tyr Phe Leu Cys Tyr Pro
20

<210> 123
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 123
Ser His Ala Pro Pro Pro Ala Leu Thr Val Ile Thr Asp Arg His Pro
1 5 10 15
Ile Ala Cys Leu Leu Cys Tyr Pro
20

<210> 124
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 124
Ser His Ala Pro Pro Pro Ala Leu Thr Leu Leu Leu Asp Arg His Pro
1 5 10 15
Ile Ala Val Met Leu Cys Tyr Pro
20

<210> 125
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 125
Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile Leu Asp Arg His Pro
1 5 10 15
Ile Ala Ser Tyr Cys Cys Tyr Pro
20

<210> 126

<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 126
Ser His Ala Pro Pro Pro Ala Leu Thr Met Phe Met Asp Arg His Pro
 1   5   10   15
Ile Ala His Asn Val Cys Tyr Pro
            20

<210> 127
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 127
Ser His Ala Pro Pro Pro Ala Leu Thr Ile Leu Leu Asp Arg His Pro
 1   5   10   15
Ile Ala Ile Tyr Leu Cys Tyr Pro
            20

<210> 128
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 128
Ser His Ala Pro Pro Pro Ala Leu Thr Phe Tyr Tyr Asp Arg His Pro
 1   5   10   15
Ile Ala Pro Phe Val Cys Tyr Pro
            20

<210> 129
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 129
Ser His Ala Pro Pro Pro Ala Leu Thr Leu Phe Leu Asp Arg His Pro
 1   5   10   15
Ile Ala Leu Met Cys Cys Tyr Pro
            20

<210> 130
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 130
Ser His Ala Pro Pro Pro Ala Leu Thr Leu Val Leu Asp Arg His Pro
 1   5   10   15
Ile Ala Tyr Tyr Leu Cys Tyr Pro
            20

<210> 131
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 131
Ser His Ala Pro Pro Pro Ala Leu Thr Cys Phe Leu Asp Arg His Pro
 1   5   10   15
Ile Ala Tyr Tyr Leu Cys Tyr Pro
            20

<210> 132
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<220>
<221> VARIANT
<222> 10
<223> Xaa = Ile OR Leu

<220>
<221> VARIANT
<222> 11
<223> Xaa = Ile OR Leu OR Phe

<220>
<221> VARIANT
<222> 12
<223> Xaa = Phe OR Ala OR Val OR Pro OR Leu

<220>
<221> VARIANT
<222> 19
<223> Xaa = Ala OR Asp OR Tyr OR Val OR Phe

<220>
<221> VARIANT
<222> 20
<223> Xaa = Leu OR Phe OR Tyr OR Ile OR Met OR Asn OR
      Lys

<400> 132
Ser His Ala Pro Pro Pro Ala Leu Thr Xaa Xaa Xaa Asp Arg His Pro

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 1               5                  10                  15
Ile Ala Xaa Xaa Leu Cys Tyr Pro
            20
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<210> 133
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<220>
<221> VARIANT
<222> 1
<223> Xaa = Ile OR Leu

<220>
<221> VARIANT
<222> 2
<223> Xaa = Ile OR Leu OR Phe

<220>
<221> VARIANT
<222> 3
<223> Xaa = Phe OR Ala OR Val OR Pro OR Leu

<220>
<221> VARIANT
<222> 10
<223> Xaa = Ala OR Asp OR Tyr OR Val OR Phe

<220>
<221> VARIANT
<222> 11
<223> Xaa = Leu OR Phe OR Tyr OR Ile OR Met OR Asn OR
Lys

<400> 133
Xaa Xaa Xaa Asp Arg His Pro Ile Ala Xaa Xaa
 1   5   10

<210> 134
<211> 376
<212> PRT
<213> Herpesviridae sp.

<400> 134
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Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
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Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 135
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 135
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
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Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Val Pro Pro Pro Ala Leu Thr Ile Leu
145                 150                 155                 160
Ala Asp Arg His Pro Ile Ala Tyr Phe Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 136
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 136
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ser Leu Thr Leu Ile
145                 150                 155                 160
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Leu Asp Arg His Pro Ile Ala Ser Tyr Cys Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 137
<211> 374
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 137
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Leu Thr Ile Leu Leu Asp
145                 150                 155                 160
Arg His Pro Ile Ala Ile Tyr Leu Cys Tyr Pro Ala Ala Arg Tyr Leu
                165                 170                 175
Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu Ile
            180                 185                 190
```

```
Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro Glu
        195                 200                 205
Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu Arg
    210                 215                 220
Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu Leu
225                 230                 235                 240
Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu Asp
                245                 250                 255
Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu Pro
            260                 265                 270
Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe Thr
        275                 280                 285
Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr Asn
    290                 295                 300
Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser Met
305                 310                 315                 320
His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg Asp
                325                 330                 335
Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr Thr
            340                 345                 350
Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala Arg
        355                 360                 365
Glu Met Gly Glu Ala Asn
    370


<210> 138
<211> 375
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 138
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Leu Thr Phe Tyr Tyr
145                 150                 155                 160
Asp Arg His Pro Ile Ala Pro Phe Val Cys Tyr Pro Ala Ala Arg Tyr
                165                 170                 175
Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu
            180                 185                 190
Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro
        195                 200                 205
Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu
    210                 215                 220
```

```
Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu
225                 230                 235                 240
Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu
                245                 250                 255
Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu
            260                 265                 270
Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe
        275                 280                 285
Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr
    290                 295                 300
Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser
305                 310                 315                 320
Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg
                325                 330                 335
Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr
            340                 345                 350
Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala
        355                 360                 365
Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 139
<211> 375
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 139
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                  5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Leu Thr Leu Val Leu
145                 150                 155                 160
Asp Arg His Pro Ile Ala Tyr Tyr Leu Cys Tyr Pro Ala Ala Arg Tyr
                165                 170                 175
Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu
            180                 185                 190
Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro
        195                 200                 205
Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu
    210                 215                 220
Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu
225                 230                 235                 240
Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu
                245                 250                 255
```

```
Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu
            260                 265                 270
Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe
        275                 280                 285
Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr
    290                 295                 300
Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser
305                 310                 315                 320
Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg
                325                 330                 335
Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr
            340                 345                 350
Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala
        355                 360                 365
Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 140
<211> 375
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 140
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                   5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Leu Thr Cys Phe Leu
145                 150                 155                 160
Asp Arg His Pro Ile Ala Tyr Tyr Leu Cys Tyr Pro Ala Ala Arg Tyr
                165                 170                 175
Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala Leu
            180                 185                 190
Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu Pro
        195                 200                 205
Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly Glu
    210                 215                 220
Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly Leu
225                 230                 235                 240
Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg Glu
                245                 250                 255
Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala Glu
            260                 265                 270
Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu Phe
        275                 280                 285
```

Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu Tyr
290 295 300
Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg Ser
305 310 315 320
Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys Arg
325 330 335
Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val Thr
340 345 350
Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe Ala
355 360 365
Arg Glu Met Gly Glu Ala Asn
370 375

<210> 141
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 141
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Ala Leu Thr Leu Ile
145 150 155 160
Val Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320

```
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 142
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 142

```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Gln Ala Leu Thr Leu Ile
145                 150                 155                 160
Ile Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
```

```
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 143
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 143

```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Gln Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 144
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 144
```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Arg Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 145
<211> 376

<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 145
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1   5   10   15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20   25   30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35   40   45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50   55   60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65   70   75   80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85   90   95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100   105   110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115   120   125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130   135   140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Arg Ala Leu Thr Leu Ile
145   150   155   160
Phe Gly Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165   170   175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180   185   190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195   200   205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210   215   220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225   230   235   240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245   250   255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260   265   270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275   280   285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290   295   300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305   310   315   320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325   330   335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340   345   350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355   360   365
Ala Arg Glu Met Gly Glu Ala Asn
    370   375

<210> 146
<211> 376
<212> PRT
<213> Artificial Sequence

<220>

<223> HSVTK Mutant

<400> 146

```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Thr Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 147
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 147

```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
```

```
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Ile Asp His His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 148
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 148

```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
```

```
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Ile Asp Arg His Arg Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 149
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 149
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
```

```
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Asn Asp Arg His Ser Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 150
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 150
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                   5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
```

```
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Tyr Cys His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 151
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 151
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
```

```
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asn Arg Lys Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 152
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 152
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                   5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Glu Arg Asn Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
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```
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 153
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 153
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                   5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Pro Gln Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
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```
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 154
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 154
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Arg Gln Leu Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
```

225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

<210> 155
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 155
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Gln Ala Leu Thr Leu Ile
145 150 155 160
Phe Glu Arg His Leu Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala

```
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 156
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 156
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                   5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Pro His Thr Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
```

290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

<210> 157
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 157
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145 150 155 160
Phe Asn Ser Asn Ala Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys

325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

<210> 158
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 158
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Ala Leu Thr Leu Ile
145 150 155 160
Cys Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe

355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

<210> 159
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 159
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
1 5 10 15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
20 25 30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
35 40 45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
50 55 60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65 70 75 80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
85 90 95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
100 105 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
115 120 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
130 135 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Ala Ala Leu Thr Leu Ile
145 150 155 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
165 170 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
180 185 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
195 200 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
210 215 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225 230 235 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
245 250 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
260 265 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
275 280 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
290 295 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305 310 315 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
325 330 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
340 345 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
355 360 365
Ala Arg Glu Met Gly Glu Ala Asn
370 375

<210> 160
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 160
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1   5   10   15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20   25   30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35   40   45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50   55   60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65   70   75   80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85   90   95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100   105   110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115   120   125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130   135   140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Leu
145   150   155   160
Leu Asp Arg His Pro Ile Ala Val Met Leu Cys Tyr Pro Ala Ala Arg
                165   170   175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180   185   190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195   200   205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210   215   220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225   230   235   240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245   250   255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260   265   270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275   280   285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290   295   300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305   310   315   320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325   330   335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340   345   350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355   360   365
Ala Arg Glu Met Gly Glu Ala Asn
    370   375

<210> 161
<211> 376
<212> PRT

<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 161
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1   5   10   15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20   25   30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35   40   45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50   55   60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65   70   75   80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85   90   95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100   105   110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115   120   125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130   135   140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145   150   155   160
Leu Asp Arg His Pro Ile Ala Val Tyr Cys Cys Tyr Pro Ala Ala Arg
                165   170   175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180   185   190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195   200   205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210   215   220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225   230   235   240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245   250   255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260   265   270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275   280   285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290   295   300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305   310   315   320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325   330   335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340   345   350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355   360   365
Ala Arg Glu Met Gly Glu Ala Asn
    370   375

<210> 162
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 162
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1   5   10   15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20   25   30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35   40   45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50   55   60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65   70   75   80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85   90   95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100   105   110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115   120   125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130   135   140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145   150   155   160
Ile Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165   170   175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180   185   190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195   200   205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210   215   220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225   230   235   240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245   250   255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260   265   270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275   280   285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290   295   300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305   310   315   320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325   330   335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340   345   350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355   360   365
Ala Arg Glu Met Gly Glu Ala Asn
    370   375

<210> 163
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 163
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1   5   10   15

```
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Cys Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
```

<210> 164
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 164

```
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
```

```
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Leu Asp Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 165
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 165
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                  5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
```

```
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Arg His Pro Ile Ser Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 166
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 166
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
```

```
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Arg His Pro Ile Ser Ala Leu Leu Cys Tyr Pro Val Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 167
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 167
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
```

```
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Arg His Ala Ile Ala Ala Leu Leu Cys Tyr Pro Val Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 168
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 168
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                   5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Gly Arg His Ala Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
```

```
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 169
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 169
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Glu Arg His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
```

```
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 170
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 170
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1               5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Pro His Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
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Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375


<210> 171
<211> 376
<212> PRT
<213> Artificial Sequence

<220>
<223> HSVTK Mutant

<400> 171
Met Ala Ser Tyr Pro Gly His Gln His Ala Ser Ala Phe Asp Gln Ala
 1                  5                  10                  15
Ala Arg Ser Arg Gly His Ser Asn Arg Arg Thr Ala Leu Arg Pro Arg
            20                  25                  30
Arg Gln Gln Glu Ala Thr Glu Val Arg Leu Glu Gln Lys Met Pro Thr
        35                  40                  45
Leu Leu Arg Val Tyr Ile Asp Gly Pro His Gly Met Gly Lys Thr Thr
    50                  55                  60
Thr Thr Gln Leu Leu Val Ala Leu Gly Ser Arg Asp Asp Ile Val Tyr
65                  70                  75                  80
Val Pro Glu Pro Met Thr Tyr Trp Gln Val Leu Gly Ala Ser Glu Thr
                85                  90                  95
Ile Ala Asn Ile Tyr Thr Thr Gln His Arg Leu Asp Gln Gly Glu Ile
            100                 105                 110
Ser Ala Gly Asp Ala Ala Val Val Met Thr Ser Ala Gln Ile Thr Met
        115                 120                 125
Gly Met Pro Tyr Ala Val Thr Asp Ala Val Leu Ala Pro His Ile Gly
    130                 135                 140
Gly Glu Ala Gly Ser Ser His Ala Pro Pro Pro Ala Leu Thr Leu Ile
145                 150                 155                 160
Phe Asp Arg Gln Pro Ile Ala Ala Leu Leu Cys Tyr Pro Ala Ala Arg
                165                 170                 175
Tyr Leu Met Gly Ser Met Thr Pro Gln Ala Val Leu Ala Phe Val Ala
            180                 185                 190
Leu Ile Pro Pro Thr Leu Pro Gly Thr Asn Ile Val Leu Gly Ala Leu
        195                 200                 205
Pro Glu Asp Arg His Ile Asp Arg Leu Ala Lys Arg Gln Arg Pro Gly
    210                 215                 220
Glu Arg Leu Asp Leu Ala Met Leu Ala Ala Ile Arg Arg Val Tyr Gly
225                 230                 235                 240
Leu Leu Ala Asn Thr Val Arg Tyr Leu Gln Cys Gly Gly Ser Trp Arg
                245                 250                 255
Glu Asp Trp Gly Gln Leu Ser Gly Thr Ala Val Pro Pro Gln Gly Ala
            260                 265                 270
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Glu Pro Gln Ser Asn Ala Gly Pro Arg Pro His Ile Gly Asp Thr Leu
        275                 280                 285
Phe Thr Leu Phe Arg Ala Pro Glu Leu Leu Ala Pro Asn Gly Asp Leu
    290                 295                 300
Tyr Asn Val Phe Ala Trp Ala Leu Asp Val Leu Ala Lys Arg Leu Arg
305                 310                 315                 320
Ser Met His Val Phe Ile Leu Asp Tyr Asp Gln Ser Pro Ala Gly Cys
                325                 330                 335
Arg Asp Ala Leu Leu Gln Leu Thr Ser Gly Met Val Gln Thr His Val
            340                 345                 350
Thr Thr Pro Gly Ser Ile Pro Thr Ile Cys Asp Leu Ala Arg Thr Phe
        355                 360                 365
Ala Arg Glu Met Gly Glu Ala Asn
    370                 375
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<210> 172
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Primer

<400> 172
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